Title: Sectors of Pizza

Link to Outcomes:

- **Problem Solving** — Students will solve problems with more than one approach.

- **Communication** — Students will discuss geometric concepts with other students and present their findings in a written summary.

- **Connections** — Students will relate the circles used in geometry to a real-life situation.

- **Measurement** — Students will use *The Geometric Supposer - Circles* to measure arc lengths, areas of sectors of a circle, and angles.

- **Geometry** — Students will reinforce knowledge of arc length, areas of a circle and sectors of a circle, and measures of central angles.

- **Technology** — Students will use *The Geometric Supposer - Circles* to speed calculations and draw models.

- **Cooperation** — Students will demonstrate the ability to investigate mathematics in small groups.

Brief Overview:

Students will apply their knowledge of circles by using technology with practical applications. This learning unit is designed to be an enrichment and/or culminating activity.

Grade/Level:

Grades 9-12, Algebra, Geometry, Consumer Math

Duration:

One or two class periods required, extension applications may require additional time.

Prerequisite Knowledge:

- Terminology of circles, i.e., radius, diameter, central angle.
- Formulas for area and circumference of circles
- Proficiency in the use of *The Geometric Supposer*™ or *Geometer's Sketchpad*™

Objectives:

Students will:

- find the area of a sector of a circle.
- find the length of an arc of a circle.
- compute the measure of a central angle of a circle.
- calculate the cost of preparation of a pizza.

Materials/Resources/Printed Materials:

- Computer and software
- Scientific calculator
- Student Worksheets
- Pizza(s)

Development/Procedures:

The teacher could arrange students in small groups prior to the lesson for maximum use of the available computers. A member of the group should record the ideas, results, and procedures used to complete the activity.

Activity 1

- Students will use the *Geometric Supposer*™ or any geometry software to compute the area and circumference of a circle. Proficiency in the use of the software is needed.
- Students will use the geometry software to compute the area of a sector of a circle.
- Working in small groups, students will discuss the techniques used in finding the area of the sector and will develop the formula.
- Class discussion will confirm the validity of the formula.

Activity 2

- Students will use the geometry software to compute the arc length of a circle.
- Working in small groups, students will discuss the techniques used in finding the arc length of the circle and will develop a formula.
- Class discussion will confirm the validity of the formula.
- In Trigonometry, students will compute the measure of the central angle of a circle when given the length of the arc of the circle.
- Working in small groups, students will discuss the techniques used in finding the central angle of the circle and will develop the formula.
- Class discussion will confirm the validity of the formula.

Activity 3

- Each student will produce a summary of his activities and findings.

Activity 4

- Students will use pricing information to calculate the amount and cost of ingredients to prepare different sizes of pizza.

Activity 5

- Students will research the current wholesale cost of ingredients and determine the price needed to realize a given profit margin.

Activity 6

- Students will have a pizza available to complete the pizza quiz.

Extension:

Researching wholesale cost of ingredients to determine prices could be expanded to a unit in a Consumer Math class. Cost of labor and overhead as well as materials could be calculated. Profit margins for different circumstances could be considered.

Evaluation:

Students will write a summary of the activity. Teacher observation of students' participation in and completion of the activities will be part of the evaluation. A "Pizza Quiz" will follow the summary.

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STUDENT GROUP ACTIVITY SHEET

Activity 1:

- Using the geometry software, draw a circle "A" with the radius of 4 units.
- Divide the circle into 4 equal parts.
- Find the area of the circle and the area of one of the sectors.
- Divide the circle into 8 equal parts, and find the area of a sector.
- Divide the circle into 16 equal parts, and find the area of a sector.
- Using the area of the circle and the area of the sectors, decide if there is a pattern to determine how one derives the answers.
- Write the formula for finding the area of a sector of a circle.

Activity 2:

- Using the geometry software, draw a new circle with the radius of 4 units, and divide it into 4 equal parts.
- Find the circumference and then find the arc length of one of the minor arcs.
- Divide the circle into 8 equal parts, and find the arc length of one of the minor arcs.
- Divide the circle into 16 parts, and find the length of one of the minor arcs.
- Using the circumference of the circle and the arc lengths, look for a pattern.
- Write the formula for finding the length of an arc of a circle.

Extension for Trigonometry:

- Using the arc lengths in **Activity 2**, find the measure of the central angles.
- Develop a formula for finding the measure of a central angle of a circle.

Activity 3:

- Write a summary of what was discovered in **Activity 1** and **Activity 2**.

Example of template for student drawings from *Geometric Supposer*™.
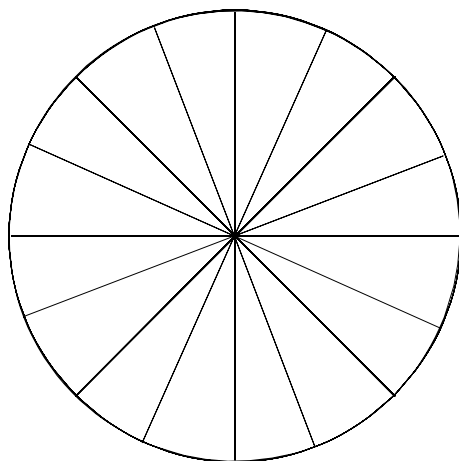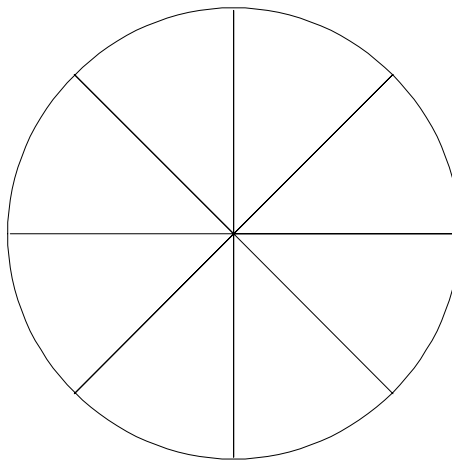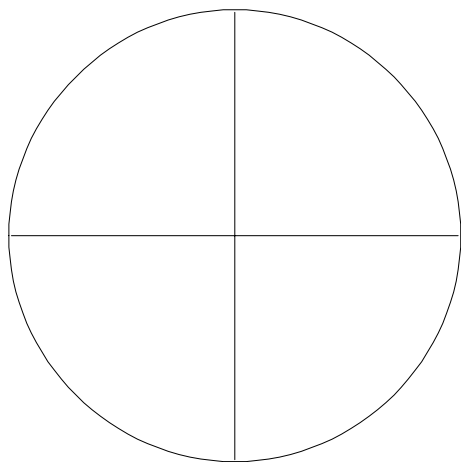
Activity 4:

Pizza ingredients	Cost	Coverage
Cheese	$.16/oz.	10 sq. in.
Sauce	$.07/oz.	28 sq. in.
Dough	$.17/2 oz.	24 sq. in.
Pepperoni	$.18/4 slices	
Sausage	$.10/oz.	

- Figure the cost of a twelve-inch cheese pizza.
- If you wanted to realize a 65% profit, what would the price of the pizza be?
- If you cut the pizza into 8 slices, what would be the cost of a slice?
- If you wanted to realize a 65% profit, what would be the price of a slice?
- How many ounces of sausage could you put on a 12-inch pizza to keep the cost of the pizza at approximately $3.75?
- How many slices of pepperoni could you put on a 12-inch pizza to keep the cost of the pizza at approximately $3.75?

Figure the same costs for a ten-inch pizza and a fifteen-inch pizza.

Extension:

Other ingredients such as mushrooms, onions, green peppers, etc. could be added, as well as, combination pizza costs and prices.

Activity 5:

Using advertisements and information obtained from wholesalers or other sources, figure the cost of making a pizza with a profit margin that could attract customers from major competitors. Be sure to include all specifications for the pizza and its production.

Teacher Answer Sheet

Example and solutions from the *Geometric Supposer*™

Data

a:A = 50.27
a:C▶F = 12.57
a:C▶H = 6.28
a:L▶H = 3.14
1:c:A = 25.13
1:C▶F = 6.28
1:C▶H = 3.14
1:L▶H = 1.57
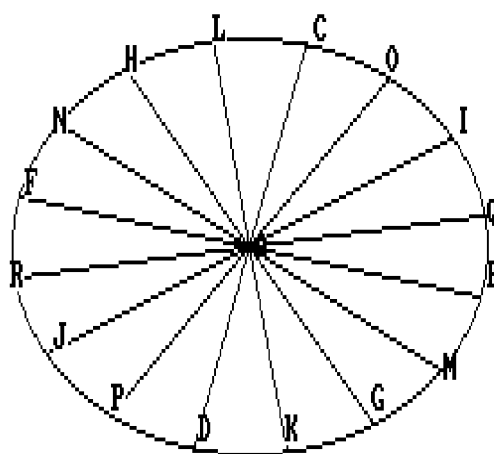
Pizza Quiz   Name _____

                                                        Date_____ Pd _____

Before any pizza is eaten, answer the following questions.

1. What is the radius of the pizza?

   r = _____

2. What is the measure of the central angle ($\angle 1$) of your slice of pizza?

   m$\angle 1$ = _____

3. What is the arc length of your slice of pizza?

   arc length = _____

4. What is the area of your slice of pizza?

   A = _____

5. Find the total area of pizza which you ate.

   A = _____

6. How much did the pieces of pizza which you ate cost?

   $_____